In the Claims:

1. (Cancelled).

2. (Currently Amended) The method of claim [[1]] 16, further comprising receiving the channel state information from the receivers.

3. (Currently Amended) The method of claim [[1]] 16, wherein the pre-coding signal weights are elements of a pre-coding matrix P, and wherein determining further comprises determining the pre-coding signal weights to enhance diagonal elements of a combined communication channel matrix $C = HP$, where H is a matrix of the channel state information.

4. (Currently Amended) The method of claim 3, wherein determining the pre-coding signal weights to enhance the diagonal elements comprises determining the pre-coding signal weights to maximize the diagonal elements of C, and wherein determining the pre-coding signal weights further comprises determining the pre-coding signal weights to force off-diagonal elements of C to zero.

5. (Currently Amended) ~~The method of claim 4,~~ A method of processing signals to be transmitted to receivers on a plurality of communication channels, comprising:

determining pre-coding signal weights based on channel state information associated with the plurality of communication channels to provide proportional power allocation to the signals; and

applying the pre-coding signal weights to the signals,

wherein the pre-coding signal weights are elements of a pre-coding matrix P,

wherein determining further comprises determining the pre-coding signal weights to enhance diagonal elements of a combined communication channel matrix $C = HP$, where H is a matrix of the channel state information; and

wherein $P = \begin{bmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{bmatrix}$, wherein $H = \begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix}$, and wherein determining comprises selecting the pre-coding signal weights of P such that

$$|p_{11}| \propto \left| h_{11} - \frac{h_{12}h_{21}}{h_{22}} \right|;$$

$$|p_{22}| \propto \left| h_{22} - \frac{h_{12}h_{21}}{h_{11}} \right|;$$

$$p_{12} = -\frac{h_{12}p_{22}}{h_{11}}; \text{ and}$$

$$p_{21} = -\frac{h_{21}p_{11}}{h_{22}}.$$

6. (Currently Amended) The method of claim 3, implemented in a transmitter having M antennas comprising sub-groups of antennas respectively associated with <u>the</u> sub-groups of the plurality of communication channels, wherein C comprises a plurality of groups of rows respectively associated with the sub-groups of the plurality of communication channels and a plurality of groups of columns respectively associated with the sub-groups of [[the]] antennas, and wherein determining <u>the</u> pre-coding signal weights further comprises determining the <u>pre-coding</u> signal weights to force each element of C positioned in a row associated with one of the sub-groups of the plurality of communication channels and a column associated with [[a]] <u>the</u> sub-group of antennas that is associated with a different one of the sub-groups of the plurality of communication channels to zero.

7. (Original) The method of claim 6, wherein the sub-groups of the plurality of communication channels comprise U sub-groups each having N communication channels, wherein $M = U * N$, wherein the sub-groups of antennas comprise M / U sub-groups each having N antennas, wherein each of the plurality of groups of rows comprises N rows, and wherein each of the plurality of groups of columns comprises N columns.

8. (Currently Amended) The method of claim 6, wherein the sub-groups of the plurality of communication channels comprise U sub-groups, an i th sub-group of the plurality of communication channels having N_i communication channels, wherein $M = \sum_{i=1}^{U} N_i$, wherein the sub-groups of antennas comprise M / U sub-groups, wherein an i th sub-group of [[the]]

antennas comprises N_i antennas, wherein an ith group of rows of the plurality of groups of rows comprises N_i rows, and wherein an ith group of columns of the plurality of groups of columns comprises N_i columns.

9. (Currently Amended) The method of claim 7, wherein M=4, N=2, U=2, and wherein determining the pre-coding signal weights comprises selecting the pre-coding signal weights of P such that

$$C = HP = \begin{bmatrix} c_{11} & c_{12} & 0 & 0 \\ c_{21} & c_{22} & 0 & 0 \\ 0 & 0 & c_{33} & c_{34} \\ 0 & 0 & c_{43} & c_{44} \end{bmatrix},$$

where [[the]] a group of the first two rows of C is associated with a first of [[the]] two sub-groups of the plurality of communication channels, [[the]] a group of the third and fourth rows of C is associated with a second of the two sub-groups of the plurality of communication channels, [[the]] a group of the first two columns of C is associated with a first of [[the]] two sub-groups of two antennas, and [[the]] a group of the third and fourth columns of C is associated with a second of the two sub-groups of two antennas.

10. (Currently Amended) The method of claim [[1]] 16, wherein applying the pre-coding signal weights comprises a first interference cancellation operation of an interference cancellation task, and wherein the interference cancellation task further comprises a second interference cancellation task to be performed at the receivers.

11. (Currently Amended) The method of claim 10, wherein the signals comprise respective groups of signals to be transmitted to the receivers, wherein determining the pre-coding signal weights further comprises determining the pre-coding signal weights to separate the respective groups of signals.

12. (Currently Amended) The method of claim 11, implemented at a transmitter in a multi-user MIMO (Multiple Input Multiple Output) communication system that provides respective

$N \times N$ sub-MIMO channels from the transmitter to the receivers, wherein each of the respective groups of signals comprises N signals.

13. (Currently Amended) ~~The method of claim 12,~~ A method of processing signals to be transmitted to receivers on a plurality of communication channels, comprising:

determining pre-coding signal weights based on channel state information associated with the plurality of communication channels to provide proportional power allocation to the signals; and

applying the pre-coding signal weights to the signals,

wherein the method is implemented at a transmitter in a multi-user MIMO (Multiple Input Multiple Output) communication system that provides respective $N \times N$ sub-MIMO channels from the transmitter to the receivers, wherein each of the groups of signals comprises N signals,

wherein the signals comprise respective groups of signals to be transmitted to the receivers, wherein determining the pre-coding signal weights further comprises determining the pre-coding signal weights to separate the respective groups of signals, and

wherein determining the pre-coding signal weights comprises determining elements of a pre-coding matrix P such that a combined communication channel matrix $C = HP$ has a form of U $N \times N$ sub-matrices, diagonal elements of which are respective diagonal elements of C, and elements of C outside the ~~plurality of~~ $N \times N$ sub-matrices are forced to zero.

14. (Original) The method of claim 13, wherein the transmitter has M=4 antennas, wherein

$$U=2,\ N=2,\ P = \begin{bmatrix} p_{11} & p_{12} & p_{13} & p_{14} \\ p_{21} & p_{22} & p_{23} & p_{24} \\ p_{31} & p_{32} & p_{33} & p_{34} \\ p_{41} & p_{42} & p_{43} & p_{44} \end{bmatrix},\ H = \begin{bmatrix} h_{11} & h_{12} & h_{13} & h_{14} \\ h_{21} & h_{22} & h_{23} & h_{24} \\ h_{31} & h_{32} & h_{33} & h_{34} \\ h_{41} & h_{42} & h_{43} & h_{44} \end{bmatrix},$$

$$C = HP = \begin{bmatrix} c_{11} & c_{12} & 0 & 0 \\ c_{21} & c_{22} & 0 & 0 \\ 0 & 0 & c_{33} & c_{34} \\ 0 & 0 & c_{43} & c_{44} \end{bmatrix}$$, wherein determining elements of P comprises:

selecting p_{31}, p_{41}, p_{32}, and p_{42} to force $c_{13} = c_{14} = c_{23} = c_{24}$=0;

selecting $\begin{cases} p_{11} = va_{11}^* \\ p_{21} = va_{12}^* \\ p_{12} = va_{21}^* \\ p_{22} = va_{22}^* \end{cases}$, where v is a power normalization factor and a_{ij} are elements of A, where $A = \begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix} - \frac{1}{\Delta} \begin{bmatrix} h_{13} & h_{14} \\ h_{23} & h_{24} \end{bmatrix} \begin{bmatrix} h_{44} & -h_{34} \\ -h_{43} & h_{33} \end{bmatrix} \begin{bmatrix} h_{31} & h_{32} \\ h_{41} & h_{42} \end{bmatrix}$ and $\Delta = h_{33}h_{44} - h_{34}h_{43}$;

selecting p_{13}, p_{23}, p_{14}, and p_{24} to force $c_{31} = c_{32} = c_{41} = c_{42}$=0; and

selecting $\begin{cases} p_{33} = va_{11}^* \\ p_{43} = va_{12}^* \\ p_{34} = va_{21}^* \\ p_{44} = va_{22}^* \end{cases}$, where a_{ij} are elements of A, where

$A = \begin{bmatrix} h_{33} & h_{34} \\ h_{43} & h_{44} \end{bmatrix} - \frac{1}{\Delta} \begin{bmatrix} h_{31} & h_{32} \\ h_{41} & h_{42} \end{bmatrix} \begin{bmatrix} h_{22} & -h_{12} \\ -h_{21} & h_{11} \end{bmatrix} \begin{bmatrix} h_{13} & h_{14} \\ h_{14} & h_{24} \end{bmatrix}$, and $\Delta = h_{11}h_{22} - h_{12}h_{21}$.

15. (Currently Amended) A computer program product comprising a computer-readable medium storing instructions which, when executed by a processor, perform the method of claim [[1]] <u>16</u>.

16. (Currently Amended) ~~The method of claim 1, further comprising:~~ <u>A method of processing signals to be transmitted to receivers on a plurality of communication channels, comprising:</u>

<u>determining pre-coding signal weights based on channel state information associated with the plurality of communication channels to provide proportional power allocation to the signals;</u>

<u>applying the pre-coding signal weights to the signals;</u>

transmitting [[the]] weighted signals to the receivers on the plurality of communication channels; and

at each of the receivers:

receiving a subset of the weighted signals over a sub-group of the plurality of communication channels; and

decoding the ~~received~~ subset of the weighted signals using inverses of the pre-coding signal weights based on the channel state information associated with the sub-group of the plurality of communication channels.

17. (Currently Amended) A method comprising:

receiving over a sub-group of a plurality of communication channels a subset of a plurality of signals to which pre-coding signal weights based on channel state information associated with the sub-group of the plurality of communication channels to provide proportional power allocation have been applied; and

decoding the ~~received~~ subset of the plurality of signals using inverses of the pre-coding signal weights based on the channel state information associated with the sub-group of the plurality of communication channels.

18. (Original) The method of claim 17, further comprising:

determining the channel state information for the sub-group of the plurality of communication channels.

19. (Currently Amended) The method of claim 18, wherein receiving the subset of the plurality of signals comprises receiving the subset of the plurality of signals from a transmitter, further comprising:

transmitting the channel state information for the sub-group of the plurality of communication channels to the transmitter.

20. (Currently Amended) The method of claim 17, wherein the pre-coding signal weights are elements of a pre-coding matrix P determined to enhance diagonal elements of a combined communication channel matrix $C = HP$, where H is a matrix of the channel state information associated with the sub-group of the plurality of communication channels, and wherein decoding comprises decoding the ~~received~~ subset of the plurality of signals using an inverse of either P or C.

21. (Original) The method of claim 20, wherein the inverse is a Moore-Penrose pseudo-inverse matrix.

22. (Currently Amended) The method of claim 17, wherein receiving <u>the subset of the plurality of signals</u> comprises receiving the subset of the plurality of signals at respective antennas.

23. (Original) The method of claim 17, wherein the pre-coding weights separate the plurality of signals into subsets comprising the subset of the plurality of signals as a first interference cancellation operation, and wherein decoding comprises performing a further interference cancellation operation.

24. (Original) The method of claim 23, wherein decoding comprises ML (Maximum Likelihood) decoding.

25. (Currently Amended) The method of claim 23, wherein performing [[a]] <u>the</u> further interference cancellation operation comprises separating individual signals from the subset of the plurality of signals.

26. (Original) The method of claim 17, implemented at a receiver in a multi-user MIMO (Multiple Input Multiple Output) communication system that provides an $N \times N$ sub-MIMO channel to the receiver, wherein the subset of the plurality of signals comprises N signals.

27. (Currently Amended) The method of claim 26, wherein the pre-coding signal weights are elements of a pre-coding matrix P determined such that a combined communication channel matrix $C = HP$ has a form of U $N \times N$ sub-matrices, and wherein decoding comprises decoding the ~~received~~ subset of the plurality of signals using an inverse of one of the U $N \times N$ sub-matrices.

28. (Original) A computer program product comprising a computer-readable medium storing instructions which, when executed by a processor, perform the method of claim 17.

29. (Cancelled).

30. (Cancelled).

31. (Cancelled).

32. (Currently Amended) ~~The system of claim 29,~~ A system for processing signals to be transmitted to receivers on a plurality of communication channels comprising:

an input means for receiving the signals; and

a processor configured to determine pre-coding signal weights based on channel state information associated with the plurality of communication channels to provide proportional power allocation to the signals, and to apply the pre-coding signal weights to the signals,

wherein the system is implemented at a network element of a communication network, the communication network further comprising a plurality of receivers, each receiver of the plurality of receivers comprising:

an input means for receiving a subset of [[the]] weighted signals over a sub-group of the plurality of communication channels; and

a processor configured to decode the ~~received~~ subset of the weighted signals using inverses of the pre-coding signal weights based on the channel state information associated with the sub-group of the plurality of communication channels.

33. (Currently Amended) The system of claim 32, wherein the communication network is selected from [[the]] a group consisting of: a MIMO (Multiple Input Multiple Output) system [[is]] and a MIMO BLAST system.

34. (Currently Amended) The system of claim 32, wherein the processor of each receiver of the plurality of receivers is further configured to determine and feed back to the network element a portion of the channel state information.

35. (Currently Amended) A system comprising:

an input <u>means</u> for receiving over a sub-group of a plurality of communication channels a subset of a plurality of signals to which pre-coding signal weights based on channel state information associated with the <u>sub-group of the</u> plurality of communication channels to provide proportional power allocation have been applied; and

a processor configured to decode the ~~received~~ subset of the plurality of signals using inverses of the pre-coding signal weights based on <u>the</u> channel state information associated with the sub-group of the plurality of communication channels.

36. (Original) The system of claim 35, wherein the processor implements an ML (Maximum Likelihood) decoder.

37. (Original) The system of claim 35, wherein the processor is further configured to cancel interference between each signal in the subset of the plurality of signals.

38. (Original) The system of claim 35, implemented in a MIMO (Multiple Input Multiple Output) communication system, further comprising:

a plurality of antennas,

wherein the plurality of antennas provides a sub-MIMO communication channel comprising the sub-group of the plurality of communication channels.

39. (Currently Amended) A method of processing signals to be concurrently transmitted to receivers over a plurality of communication channels comprising:

determining channel state information for the plurality of communication channels;

determining a spatial coding matrix comprising a respective set of spatial coding weights for each of the receivers based on the channel state information; and

applying the <u>respective set of</u> spatial coding weights in the spatial coding matrix to the signals.

40. (Original) The method of claim 39, wherein the signals comprise a plurality of groups of at least one signal to be transmitted to respective ones of the receivers.

41. (Currently Amended) The method of claim 40, wherein the plurality of groups of ~~signals~~ at least one signal comprises groups of signals comprising different numbers of signals.

42. (Currently Amended) The method of claim 39, wherein determining the channel state information comprises:

receiving portions of the channel state information from the receivers; and

combining the portions of the channel state information to form the channel state information.

43. (Currently Amnede) The method of claim 40, further comprising:

transmitting the signals to the receivers,

wherein the spatial coding matrix F comprises elements $[F^{(1)}, F^{(2)}, \ldots F^{(U)}]$, U an integer, where each element $F^{(i)}$ is the respective set of spatial coding weights for an i^{th} one of the receivers and satisfies $tr\{F^{(i)}F^{(i)'}\} = tr\{F^{(i)'}F^{(i)}\} = P_s$, $i=1, 2, .., U$, where $tr\{\bullet\}$ is [[the]] a trace of a matrix, and P_s is a total transmitted power of the signals.

44. (Currently Amended) The method of claim 43, implemented in a MIMO (Multiple Input Multiple Output) communication system, wherein determining a spatial coding matrix comprises determining the elements $F^{(i)}$ of F as

$$F^{(i)} = \sqrt{P_s}\frac{\hat{G}^{(i)'}}{\sqrt{tr(\hat{G}^{(i)'}\hat{G}^{(i)})}},$$

where

$\hat{G}^{(i)} = \hat{H}_F^{(i)'}(\hat{H}_F\hat{H}_F' + I_{N_t})^{-1}$, $i = 1,2,\ldots U$, is a set of [[the]] demodulation weights corresponding to $F^{(i)}$;

$\hat{H}_F = [\hat{H}_F^{(1)}, \ldots \hat{H}_F^{(U)}]$;

$\hat{H}_F^{(i)} = (\hat{H}^{(i)}\hat{F}^{(i)})/\sqrt{2\sigma_{n,i}^2}$ is a combined channel matrix of a virtual reverse MIMO channel from the ith receiver;

$\hat{H}^{(i)} = [H^{(i)}]'$ is a matrix of <u>the</u> channel state information of the virtual reverse MIMO channel from the ith receiver;

$H^{(i)}$ is a matrix of <u>the</u> channel state information for a forward MIMO channel of [[the]] <u>a</u> plurality of channels to the ith receiver;

$\hat{F}^{(i)}$ is a [[space]] <u>spatial</u> coding matrix of the virtual reverse MIMO channel from the ith receiver;

I_{N_i} is a unit matrix;

N_i is a number of signals in the ~~one of the~~ plurality of groups of <u>at least one signal</u> ~~signals~~ to be transmitted to the ith receiver; and

$\sigma_{\eta,i}^{2}$ is a variance of a component of noise at the ith receiver.

45. (Original) The method of claim 44, further comprising:

transmitting a respective set of demodulation weights $\hat{G}^{(i)}$ to each of the receivers.

46. (Currently Amended) The method of claim 44, wherein $\hat{F}^{(i)} = \overline{V}^{(i)}\Phi^{(i)}$ where

$\overline{V}^{(i)}$ is a matrix constructed from columns of $V^{(i)}$;

$V^{(i)}$ is a unitary matrix resulting from the singular decomposition of a channel matrix $H^{(i)}$ of a MIMO channel to the ith receiver as $\widetilde{H}^{(i)} = U^{(i)}\Lambda^{(i)}V^{(i)H}$, where $U^{(i)}$ and $V^{(i)}$ are unitary matrices, $\Lambda^{(i)}$ is a non-negative diagonal matrix, [[the]] squares of diagonal elements of $\Lambda^{(i)}$ are equal to eigenvalues of an $\hat{H}^{(i)}\hat{H}^{(i)'}$ matrix, [[the]] columns of $U^{(i)}$ are eigenvectors of the $\hat{H}^{(i)}\hat{H}^{(i)'}$ matrix, and [[the]] columns of $V^{(i)}$ are also eigenvectors of the $\hat{H}^{(i)}\hat{H}^{(i)'}$ matrix; and

$\Phi^{(i)}$ is a diagonal matrix having non-negative diagonal elements that determine channel power allocation and satisfy $tr(\hat{F}^{(i)}\hat{F}^{(i)'}) = \sum_{k=1}^{K_{ch,i}} \phi^{(i)}{}_{k,k}{}^{2} = P_s$, where $K_{ch,i}$ is a number of spatial channels to the ith receiver.

47. (Currently Amended) The method of claim 46, wherein the diagonal elements of $\Phi^{(i)}$ are selected according to a criterion selected from [[the]] a group consisting of:

a uniform power criterion, $\phi^{(i)}{}_{k,k}{}^2 = P_s / K_{ch,i}$;

an MMSE (Maximum Mean Squared Error) criterion,

$$\phi^{(i)}{}_{k,k}{}^2 = 2\sigma_{\eta,i}{}^2 \left[\frac{\mu}{\sqrt{\xi^{(i)}{}_{k,k}}} - \frac{1}{\xi^{(i)}{}_{k,k}} \right]^+ ;$$

an MSER (Minimum Symbol-Error-Rate) criterion, $\phi^{(i)}{}_{k,k}{}^2 = \dfrac{2\sigma_{\eta,i}{}^2}{\xi^{(i)}{}_{k,k}} \left[\log\left(\dfrac{\xi^{(i)}{}_{k,k}}{2\sigma_{\eta,i}{}^2} \right) - \mu \right]^+$;

and

an MCIR (Maximum Capacity and Information Rate) criterion, $\phi^{(i)}{}_{k,k}{}^2 = \left(\mu - \dfrac{2\sigma_{\eta,i}{}^2}{\xi^{(i)}{}_{k,k}} \right)^+$,

where

$(\bullet)^+ = \max(\bullet, 0) = \frac{1}{2}(|\bullet| + \bullet)$;

$\xi^{(i)}{}_{k,k} = \lambda^{(i)}{}_{k,k}{}^2$ are eigenvalues of the $\hat{H}^{(i)} \hat{H}^{(i)'}$ matrix, and $\lambda^{(i)}{}_{k,k}$ are diagonal elements of the $\Lambda^{(i)}$ matrix; and

μ is a factor selected to define the MMSE, MSER, and MCIR criteria.

48. (Original) A computer program product comprising a computer-readable medium storing instructions which, when executed by a processor, perform the method of claim 39.

49. (Currently Amended) The method of claim 39, further comprising:

determining a plurality of demodulation matrices respectively corresponding to the respective set [[sets]] of spatial coding weights;

transmitting the plurality of demodulation matrices from a transmitter to the receivers;

transmitting [[the]] weighted signals to the receivers over the plurality of communication channels; and

at each of [[the]] a plurality of receivers:

receiving the weighted signals and the plurality of demodulation matrices;

determining the channel state information for a communication channel between the receiver and the transmitter; and

transmitting the channel state information to the transmitter.

50. (Original) A method comprising:

determining channel state information for a communication channel between a receiver and a transmitter;

transmitting the channel state information to the transmitter; and

receiving from the transmitter one of a plurality of demodulation matrices for demodulating subsequently received communication signals to which spatial coding weights comprising respective sets of spatial coding weights for a plurality of receivers have been applied.

51. (Original) A computer program product comprising a computer-readable medium storing instructions which, when executed by a processor, perform the method of claim 50.

52. (Currently Amended) A network element for processing signals to be concurrently transmitted to a plurality of communication terminals in a communication network, comprising:

an input means configured to receive the signals; and

a processor configured to determine channel state information for each of a plurality of communication channels between the network element and the plurality of communication terminals, to determine a spatial coding matrix comprising a respective set of spatial coding weights for each of the plurality of communication terminals based on the channel state information, and to apply the respective set of spatial coding weights in the spatial coding matrix to the signals.

53. (Currently Amended) The network element of claim 52, wherein the input means is further configured to receive portions of the channel state information from the plurality of communication terminals, and wherein the processor is further configured to combine the portions of the channel state information to thereby determine the channel state information.

54. (Currently Amended) The network element of claim 53, wherein the signals comprise respective groups of signals to be transmitted to the plurality of communication terminals, and wherein the processor implements a plurality of beamformers, each beamformer <u>of the plurality of beamformers</u> being configured to apply the <u>respective</u> sets of spatial coding weights to respective ones of the groups of the ~~plurality of~~ signals.

55. (Currently Amended) The network element of claim 52, implemented in a closed-loop multi-user MIMO (Multiple Input Multiple Output) communication system, wherein the processor of the network element is further configured to determine a respective demodulation matrix corresponding to each <u>respective</u> set of spatial coding weights, the network element further comprising:

a plurality of antennas for transmitting the respective demodulation ~~matrices~~ <u>matrix</u> and [[the]] weighted signals to the plurality of communication terminals,

wherein the <u>closed-loop multi-user MIMO</u> communication system further comprises [[a]] <u>the</u> plurality of communication terminals, each of the plurality of communication terminals comprising:

a processor configured to determine the channel state information for communication channels of the plurality of communication channels between [[the]] <u>a</u> communication terminal <u>of the plurality of communication terminals</u> and the network element; and

at least one antenna for transmitting the channel state information from the communication terminal to the network element, receiving [[a]] <u>the respective</u> demodulation matrix from the network element, and receiving the weighted signals from the network element,

wherein the processor of the communication terminal is further configured to demodulate the received weighted signals using the <u>respective</u> demodulation matrix.

56. (Cancelled).